

*Chittenden County
Decision Support System*

**FORECAST MODULE
TEST REPORT**

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Prepared for the
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and
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EXECUTIVE SUMMARY

This report presents the latest in a series of DSS tests to insure that the software is operating properly and producing results that are within acceptable ranges of accuracy for a sketch tool. This installment focuses on the DSS forecast module's sensitivity to:

- Randomness in the model's selection of developable cells for growth allocations.
- Size of cells used to contain and score growth allocations.
- Use of interval years between a forecast's base and horizon years.

Growth Allocation Sensitivity

The first sensitivity test examined the effects on indicator scores of randomness in the spatial allocation of growth. In forecast sketches, standard geographic features are converted into a grid of cells that approximate the geographic shape of the original features. Randomness occurs when the model has rated each cell with a development attractiveness score, and cells are then randomly selected within each decile of attractiveness to receive housing and/or employment growth depending on the cell's land-use designation. Random selection of cells is intended to reflect growth that does not necessarily occur first, or at all, at the most attractive locations due to either different perceptions of attractiveness or the relative similarity of attractiveness across a range of sites.

This test was accomplished by running a countywide forecast sketch several times without any parameter changes so that the only cause for indicator score change would be the slightly different spatial growth pattern created in each run by the randomness of cell selections within each decile of attractiveness. The results of the test indicate that scores are unaffected by the randomness in cell selection.

Cell Size

The second sensitivity test examined the effects on indicator scores of changing the size of cells used to contain growth and calculate indicator scores. The model allows the user to select a cell size of between 10 and 200 acres depending on size of sketch area and level of spatial detail desired in indicator scores. Generally, larger cells are appropriate for larger sketch areas in order to keep the total

number of cells manageable by the software and to present results at an appropriately broad scale. Alternatively, smaller sketch areas should have smaller cells that produce results suitably detailed for evaluating a limited area.

This test was run on a countywide forecast sketch with cells set at 50, 100, and 200 acres. The results indicate no significant change in scores at different cell sizes. Additional tests should be run with 10 to 50 acre cells at a town scale to confirm these results for the smallest cell sizes.

Interval Years

The third sensitivity test examined the effect on indicator scores of using interval years between a forecast's base and horizon years. When running forecast sketches, users may stipulate a beginning "base" year and an ending "horizon" year for a total period of up to 20 years; and optionally, they may include any number of "interval" years between the base and horizon years. By using interval years, users may examine changes in indicator scores over the course of a forecast. A key feature of the model is its recalculation of cell-to-cell travel accessibility after the base and each interval year, so as the number of interval years increases so does the successive recalculation of accessibilities. If a user chooses not to use interval years, then all of the forecast's growth is spatially allocated based only on the base year's accessibilities.

This test was run on a 20-year countywide forecast sketch with no interval years, and with one and three interval years. The results indicate that scores are not significantly altered by the presence or absence of intervals, or the number of intervals when they are used. In Chittenden's case, this may be due, in part, to relatively limited amounts of new street construction and transit expansion in future years.

1. GROWTH ALLOCATION

The first sensitivity test examined the effects on indicator scores of randomness in the spatial allocation of growth. In the forecast module, standard geographic features are converted into a grid of cells that approximate the geographic shape of the original features. During its growth allocation routine, the model rates each cell with a development attractiveness score, and cells are then randomly selected within each decile of attractiveness to receive housing and/or employment growth depending on the cell's land-use designation. Random selection of cells is intended to reflect growth that does not necessarily occur first, or at all, at the most attractive locations due to either different perceptions of attractiveness or the relative similarity of attractiveness across a range of sites.

This test was accomplished by running the same countywide forecast sketch several times without any parameter changes so that the only cause for indicator score change would be the slightly different spatial growth pattern created in each run by the randomness of cell selections within each decile of attractiveness.

Test results are presented in Table 1.1. All indicator scores were unaffected by each run's randomness, except for minor variations in remaining housing capacity. These results indicate that forecast sketches can be accomplished without concern for randomness altering indicator scores.

Table 1.1
GROWTH ALLOCATION SENSITIVITY RESULTS
 (No parameter changes)

<u>Indicators</u>	<u>Units</u>	<u>Base</u>	<u>2020</u>	<u>% Change</u>
Run A				
Population density	persons/sq.mi.	0.67	0.94	29
Housing density	dwellings/acre	0.22	0.30	28
Remaining housing capacity	dwelling units	94757	70819	-34
Employment density	employees/acre	4.69	6.82	31
Remaining employment capacity	employees	669674	629703	-6
Run B				
Population density	persons/sq.mi.	0.67	0.94	29
Housing density	dwellings/acre	0.22	0.30	28
Remaining housing capacity	dwelling units	93758	70143	-34
Employment density	employees/acre	4.69	6.82	31
Remaining employment capacity	employees	669674	629703	-6
Run C				
Population density	persons/sq.mi.	0.67	0.94	29
Housing density	dwellings/acre	0.22	0.30	28
Remaining housing capacity	dwelling units	94748	70766	-34
Employment density	employees/acre	4.69	6.82	31
Remaining employment capacity	employees	669674	629703	-6

2. CELL SIZE SENSITIVITY

The second sensitivity test examined the effects on indicator scores on changing the size of cells used to contain growth and calculate indicator scores. In the forecast module, standard geographic features are converted into a grid of cells that approximate the geographic shape of the original features. The model allows the user to select a cell size of between 10 and 200 acres depending on size of sketch area and level of detail desired in indicator scores. Generally, larger cells are appropriate for larger sketch areas in order to keep the total number of cells manageable by the software and to present results at an appropriate broad scale. Alternatively, smaller sketch areas should have smaller cells that produce results suitably detailed for a limited area.

This test was run on a countywide forecast with cells set at 50, 100, and 200 acres. The results presented in Table 2.1, and mapping examples of the cell sizes are shown in Figures 2.1 through 2.3. The results indicate that indicator scores are not significantly altered by changes in cell size at the scale of countywide sketches. Additional runs should be performed for town sketches using cells between 10 and 50 acres to confirm these results at the smallest scale of resolution.

Table 2.1
CELL SIZE SENSITIVITY RESULTS

<u>Indicators</u>	<u>Units</u>	<u>Base</u>	<u>2020</u>	<u>% Change</u>
50-acre cells				
Population density	persons/sq.mi.	0.67	0.94	29
Housing density	dwellings/acre	0.21	0.29	28
Remaining housing capacity	dwelling units	93242	69820	-34
Employment density	employees/acre	4.62	6.77	32
Remaining employment capacity	employees	686417	646301	-6
100-acre cells				
Population density	persons/sq.mi.	0.67	0.94	29
Housing density	dwellings/acre	0.22	0.30	28
Remaining housing capacity	dwelling units	94757	70819	-34
Employment density	employees/acre	4.69	6.82	31
Remaining employment capacity	employees	669674	629703	-6
200-acre cells				
Population density	persons/sq.mi.	0.66	0.93	29
Housing density	dwellings/acre	0.21	0.30	28
Remaining housing capacity	dwelling units	94383	70146	-35
Employment density	employees/acre	4.74	6.91	31
Remaining employment capacity	employees	521198	480625	-8

Figure 2.1
SAMPLE MAP OF 50-ACRE CELLS

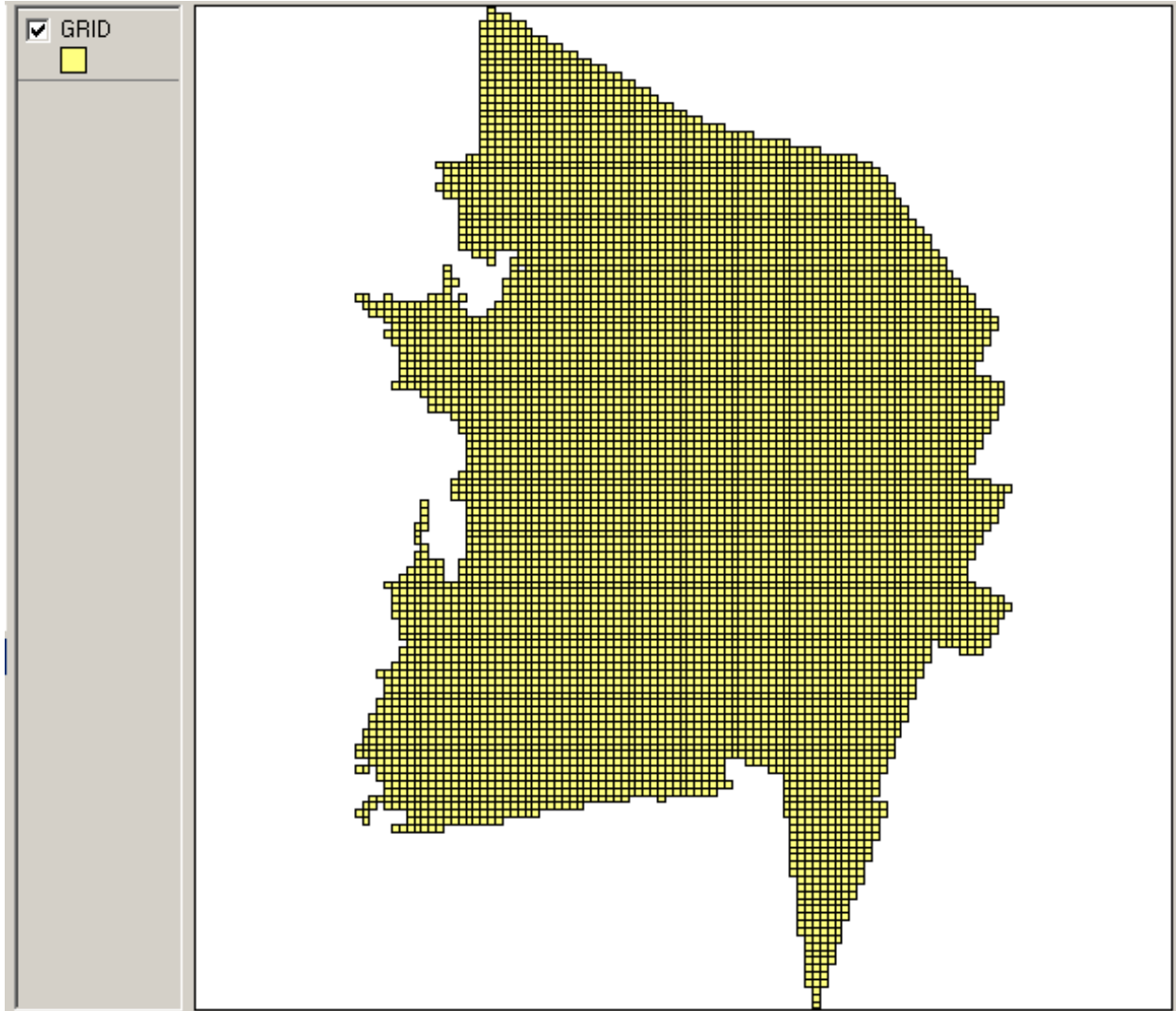


Figure 2.2
SAMPLE MAP OF 100-ACRE CELLS

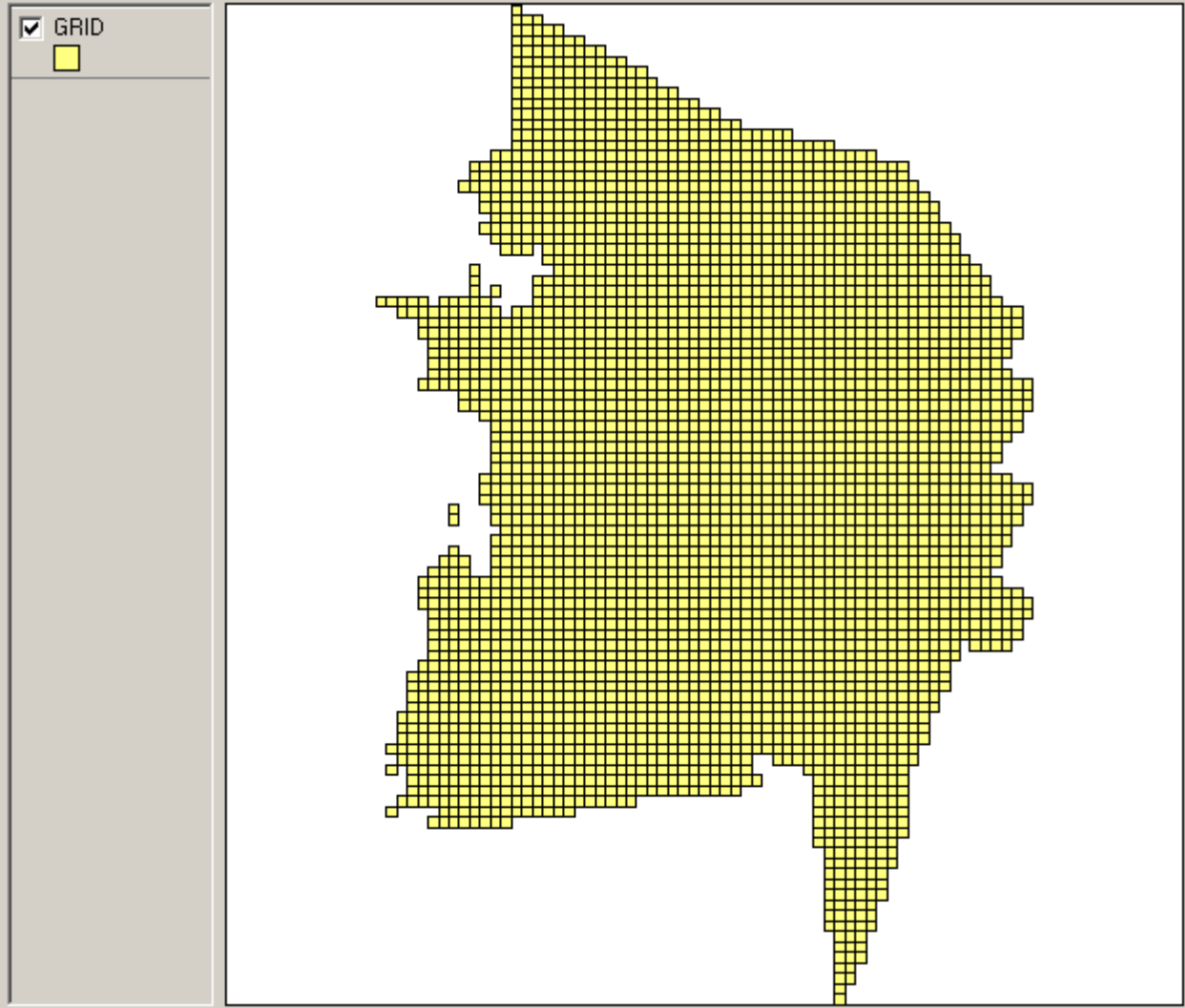


Figure 2.3
SAMPLE MAP OF 200-ACRE CELLS



3. INTERVAL YEAR SENSITIVITY

The third sensitivity test examined the effect on indicator scores of using interval years between a forecast base and horizon year. When running forecast sketches, users may stipulate a beginning “base” year and an ending “horizon” year; and optionally, they may include any number of “interval” years between the base and horizon years. By using interval years, users may examine changes in indicator scores over the course of a forecast. A key feature of the model is its recalculation of cell-to-cell transportation accessibility after the base and each interval year, so as the number of interval years increases so does the successive recalculation of accessibilities. If a user chooses not to use interval years, then all of the forecast’s growth is spatially allocated based only on the base year’s accessibility.

This test was run on a 20-year countywide forecast using three configurations: no interval years; one interval year in the 10th year; and three interval years in the 5th, 10th, and 15th years.

Test results are shown in Table 3.1, indicating that indicator scores are not significantly affected by the absence or presence of interval years, or the number of intervals when they are present. Since the use of interval years does capture the effect of travel accessibility improvements over time, one reason the interval runs for Chittenden are not showing major differences is the relatively limited amount of new street construction and transit expansion in the Chittenden forecast.

Table 3.1
INTERVAL YEAR SENSITIVITY RESULTS

<u>Indicators</u>	<u>Units</u>	<u>Base</u>	<u>2005</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
No Interval Years						
Population density	persons/sq.mi.	0.67	---	---	---	0.94
Housing density	dwellings/acre	0.22	---	---	---	0.30
Remaining housing capacity	dwelling units	94757	---	---	---	70819
Employment density	employees/acre	4.69	---	---	---	6.82
Remaining employment capacity	employees	669674	---	---	---	629703
One Interval Year						
Population density	persons/sq.mi.	0.68	---	0.80	---	0.94
Housing density	dwellings/acre	0.22	---	0.25	---	0.30
Remaining housing capacity	dwelling units	95208	---	85851	---	71144
Employment density	employees/acre	4.69	---	5.79	---	6.82
Remaining employment capacity	employees	669674	---	648888	---	629703
Three Interval Years						
Population density	persons/sq.mi.	0.69	0.75	0.80	0.87	0.94
Housing density	dwellings/acre	0.22	0.23	0.25	0.27	0.30
Remaining housing capacity	dwelling units	94640	91784	85239	78289	70574
Employment density	employees/acre	4.69	5.32	5.79	6.29	6.82
Remaining employment capacity	employees	669674	657816	648888	639616	629703